Space Telescope
Baltimore, Md. 21218

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FINAL TECHNICAL REPORT

PROJECT TITLE: *ARP 220 and the Nature of Ultraluminous Infrared Galaxies*

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ARP 220 is the most luminous object in the local Universe and the nearest, brightest, and best-studied example of the class of 'ultraluminous' infrared galaxies. These objects are of great astrophysical significance, both as low-redshift analogs to galaxy formation and as possible evolutionary precursors to quasars.

X-ray data on ARP 220 provide valuable clues as to the physics of galaxy formation and the impact that a powerful starburst and/or quasar can have on it's host galaxy and the inter-galactic medium. In order to interpret our pending Rosat PSPC and HRI X-ray data on ARP 220 and related object, we have performed a series of hydrodynamical simulations (with collaborators A. Suchkov, D.Balsara, and C. Leitherer) in which mass and kinetic energy are injected in the central region of a galaxy. The interstellar and inter-galactic medium is represented by a two-component gaseous system consisting of a relatively dense, cool disk that is centrifugally supported and a hot, tenuous halo supported by it's thermal gas pressure. The goals of the simulations are to better understand the physics of the resulting outflow ('galactic superwind'), and to allow us to interpret X-ray images and spectra of ARP 220 and related objects.

We find that there are three sources of X-ray emission: the very hot wind itself (kT = 10 keV), the halo gas that has been shock-heated by the wind (kT = 1 keV), and shock-heated disk gas that has been entrained by the wind and carried out into the galactic halo (kT = few hundred eV). In most of our simulations, the shocked halo gas dominates the X-ray emission in the Rosat band. The amount of X-rays produced depends quite sensitively on the gas densities in the disk and (especially) the halo. We also find that the disk material can be shredded into comet-like blobs that are strong sources of soft X-rays. Since the circum-galactic medium around ARP 220 and other such galaxies is likely to be quite lumpy, this process of cloud evaporation by the wind may be a very important source of soft X-rays in these systems.

A paper describing these results is in the final stages of preparation, and is expected to be submitted to the Astrophysical Journal in July.